MEMORANDUM

DATE: 26-JUL-2001

SUBJECT: PP# 6E06209. Dicamba (Distinct®, EPA Reg #7969-150) on Sweet Corn. **Evaluation of Residue Data and Analytical Methods.** MRID# 451540-01. Chemical 029801. Barcode D275611. Case 293383. Submission S590360.

FROM: George F. Kramer, Ph.D., Chemist
Registration Action Branch 1 (RAB 1)
Health Effects Division (HED) (7509C)

THRU: G. Jeffrey Herndon, Branch Senior Scientist
RAB1/HED (7509C)

TO: Shaja Brothers/Robert Forrest, PM Team 5
Registration Division (RD) (7505C)

Interregional Research Project No. 4 (IR-4) has submitted a petition on behalf of the Agricultural Experiment Stations of MN, ND and WI proposing the following permanent tolerances for the combined residues of the herbicide dicamba (3,6-dichloro-o-anisic acid) and its 5-hydroxy (5-OH) metabolite (3,6-dichloro-5-hydroxy-o-anisic acid) in/on the following raw agricultural commodities (RACs):

Corn, sweet, forage	1.0 ppm
Corn, sweet, fresh	0.1 ppm
Corn, sweet, stover	1.0 ppm

Tolerances for residues of dicamba and its 5-OH metabolite have been established for corn grain, corn forage, corn fodder, wheat grain, wheat straw, barley grain, and barley straw at 0.5 ppm; and for field corn forage, field corn stover and popcorn stover at 3.0 ppm (40 CFR § 180.227(a)). Tolerances for dicamba and its 2-OH metabolite (3,6-dichlorosalicylic acid (DCSA, or 3,6-dichloro-2-hydroxybenzoic acid) have been established at 0.05 ppm for soybeans; 0.1 ppm for soybean hay and soybean forage; and on cattle, goats, hogs, horses,

and sheep meat, fat, and meat byproducts at 0.2 ppm, liver and kidney at 1.5 ppm, and milk at 0.3 ppm (40 CFR §180.227(b)). Tolerances for dicamba and its 5-OH metabolite, resulting from the application of the sodium salt of dicamba, have been established for cottonseed at 3.0 ppm (40 CFR § 180.227(c)).

Concurrently, the petitioner has submitted a request for Section 3 registration of Distinct® Herbicide (EPA Reg. No. 7969-150), a multiple active ingredient water-dispersible granule (WDG) formulation containing 21.4% diflufenzopyr and 55% dicamba, for use on sweet corn for the control of various weeds. This residue chemistry review deals only with the use of dicamba on sweet corn. Issues pertaining to diflufenzopyr are addressed in a separate memo (J. Tyler, in preparation; D275619).

Dicamba Registration Standard was dated 12-AUG-1983, followed by a Dicamba Second Round Review on 24-MAY-1989. Dicamba is a List A chemical.

Structural Formulae:

Executive Summary of Chemistry Deficiencies

- Additional field residue trials.
- Revised Section F.

CONCLUSIONS

OPPTS GLN 860.1200: Proposed Uses

1. The petitioner has provided an adequate set of directions for the proposed use.

OPPTS GLN 860.1300: Nature of the Residue - Plants

2. The nature of the residue in plants is adequately understood (F. Griffith, 02-MAY-1996, PP#6F4604, D220469). The residues to be regulated in barley, corn, cotton, oats, wheat, and grasses are dicamba and its 5-OH metabolite; in asparagus the residues to be regulated are dicamba and DCSA; and in soybeans and aspirated grain fractions, the residues to be regulated are dicamba, 5-OH dicamba and DCSA.

OPPTS GLN 860.1300: Nature of the Residue - Livestock

3. The nature of the residue in ruminants and poultry is adequately understood (L. Cheng, 07-MAR-1996, D204482). The residues to be regulated in livestock are dicamba and its DCSA metabolite.

OPPTS GLN 860.1340: Residue Analytical Methods

4. The petitioner has presented an adequately validated capillary GC/ECD residue analytical method to determine the magnitude of dicamba and 5-OH dicamba residues in plant commodities (barley, corn, cotton, cotton processed fractions, pasture grass, peanut, sorghum, soybean, sugar cane, tomato, tomato processed fractions, wheat and wheat processed fractions). Pesticide Analytical Manual (PAM) Volume II lists Method I and II, GC methods with electron capture detection (GC/ECD), for the enforcement of tolerances on dicamba and its metabolite 5-OH dicamba in/on plant commodities and milk.

OPPTS GLN 860.1360: Multiresidue Method

5. Documentation from the FDA, PAM Volume I, Appendix II and Table 201-D, shows that dicamba is partially recovered (71 - 76%) using Protocol B.

OPPTS GLN 860.1380: Storage Stability Data

6. BASF submitted the results of a frozen storage stability study for dicamba and its metabolite 5-OH dicamba in the following field corn RACs: forage, silage, grain, and fodder (S. Chun & W. Donovan, 16-JUL-1998, D228703). The results of this study show dicamba to be stable for up to 3 years in frozen storage, and 5-OH dicamba to be stable for up to 2 years in frozen storage. As the sweet corn samples were stored for a maximum of 24 months, storage stability is not an issue for this petition.

OPPTS GLN 860.1500: Crop Field Trials

7a. A total of 9 field residue trials were conducted in Regions 1 (1 trial), 2 (1 trial), 3 (1 trial), 5 (3 trials), 6 (1 trial), 10 (1 trial) and 12 (1 trial). The number and location does not match that required for sweet corn: 12 trials conducted in Regions 1 (2 trials), 2 (1 trial), 3 (1 trial), 5 (5 trials), 10 (1 trial), 11 (1 trial) and 12 (1 trial). The petitioner previously submitted the results of 20 field corn residue trials. HED can generally translate field corn forage and stover data to sweet corn. However, in this case, translation is not appropriate as the application rate in the field corn trials was >10X the maximum sweet corn application rate.

7b. HED requests that the petitioner submit an additional 3 sweet corn residue trials conducted in Regions 1 (1 trial), 5 (1 trial) and 11 (1 trial). Permanent tolerances and a conditional registration may be established while these trials are conducted.

7c. Based on the available data, the following tolerance for residues of the herbicide dicamba and its 5-OH metabolite are appropriate for this petition:

Corn, sweet, forage	0.50 ppm
Corn, sweet, kernel plus cob with husks removed	0.04 ppm
Corn, sweet, stover	0.50 ppm

A revised Section F is required.

OPPTS GLN: 860.1520: Processed Food/Feed

8. As there are no processed commodities associated with sweet corn, processing studies not are required to support the subject petition.

OPPTS GLN 860.1480: Meat, Milk, Poultry, Eggs

9. Given that there are already dicamba tolerances established on major livestock feed items at high levels (i.e., aspirated grain fractions at 5100 ppm, grass forage at 125 ppm and wheat forage at 20 ppm), HED concludes that the dietary burden to livestock will not be affected by the use of dicamba on sweet corn.

OPPTS GLN 860.1850 and 860.1900: Confined/Field Accumulation in Rotational Crops

10. Based on the results of a confined rotational crop study (memo S. Chun & W. Donovan, 25-JUN-1998; D228694), HED has concluded that the plantback intervals specified on the Distinct® label (7 days for corn and 120 days for all other crops) are appropriate.

Other Considerations

11. There is neither a Codex proposal, nor Canadian or Mexican limits for residues of dicamba in/on sweet corn. Therefore, a compatibility issue is not relevant to the proposed tolerance. A copy of the IRLS (International Residue Limit Status) sheet is attached to this memorandum.

RECOMMENDATIONS

Provided Section F is revised as specified in Conclusion 7c, HED concludes there are no residue chemistry data requirements that would preclude the establishment of permanent tolerances for residues of dicamba and its 5-OH metabolite in/on sweet corn RACs. Registration of Distinct® should be made conditional upon the submission of additional residue data as specified in Conclusion 7b. A human-health risk assessment will be prepared as a separate document.

DETAILED CONSIDERATIONS

OPPTS GLN 860.1200: Proposed Uses

Distinct® is a selective postemergence herbicide. The maximum application rate for sweet corn is 0.14 lbs. ai/A and a maximum of 2 applications are permitted per season. The maximum seasonal use rate is 0.21 lbs. ai/A with a minimum retreatment interval of 2 weeks. Surfactants (0.25% v/v) should be added to the postemergence

finished spray. The spray volume is 3-50 gal/A by ground equipment. The PHI is 32 days for fresh corn and 72 days for stover.

The rotational crop restrictions listed on the label are 7 days for corn and 120 days for all other crops.

The petitioner has proposed an adequate set of directions for use of Distinct® on sweet corn.

Note: The revised Distinct® label also contains directions for use on popcorn and grass. Dicamba is already for use on these crops and the use rate on the Distinct® label is less than that which is already registered for dicamba alone. Issues pertaining to dicamba in/on popcorn and grass are thus not relevant to this petition.

OPPTS GLN 860.1300: Nature of the Residue - Plants

The nature of the residue in plants is adequately understood (F. Griffith, 02-MAY-1996, PP#6F4604, D220469). In most plants there is oxidation on the ring at the 5 position to form the 5-OH metabolite. In asparagus and soybeans there is demethylation on the ring at the 2 position to form the DCSA metabolite. Thus, the residues to be regulated in barley, corn, cotton, oats, wheat, and grasses are dicamba and its 5-OH metabolite; in asparagus the residues to be regulated are dicamba and DCSA; and in soybeans and aspirated grain fractions, the residues to be regulated are dicamba, 5-OH dicamba and DCSA.

OPPTS GLN 860.1300: Nature of the Residue - Livestock

The nature of the residue in ruminants and poultry is adequately understood (L. Cheng, 07-MAR-1996, D204482). In ruminants the metabolic pathway is the same as in asparagus and soybeans which is demethylation and formation of the DCSA metabolite. The same basic metabolic pathway exist in poultry; however there is a minor pathway producing a small amount of 2-amino-3,6-dichlorophenol found in poultry liver. The residues to be regulated in livestock are dicamba and its DCSA metabolite.

OPPTS GLN 860.1340: Residue Analytical Method - Plant Commodities

The petitioner has presented an adequately validated capillary GC/ECD residue analytical method to determine the magnitude of dicamba and 5-OH dicamba residues in plant commodities (barley, corn, cotton, cotton processed fractions, pasture grass, peanut, sorghum, soybean, sugar cane, tomato, tomato processed fractions, wheat and wheat processed fractions). This method (AM-0691B-0593-3) underwent a successful independent laboratory validation (D. Miller, 13-DEC-1993) and a successful EPA method validation (J. Stokes, 24-JAN-1997). This method was recently superceded by method AM-0691B-0297-4 (MRID 44394102), which consists of a more detailed step-by-step description of the procedures, GC-MS confirmatory tests, and additional recovery data. The analytical method has not been changed from method AM-0691B-0593-3. The limit of quantitation (LOQ) for dicamba and 5-OH dicamba is 0.02 ppm. PAM Volume II lists Method I and II, GC methods with electron capture detection (GC/ECD), for the enforcement of tolerances on dicamba and its metabolite 5-OH dicamba in/on plant commodities and milk.

OPPTS GLN 860.1340: Residue Analytical Methods - Livestock Commodities

The GC/EC method, AM-0685 (MRID 00079744) detects residues of dicamba and 3,6-dichloro-2-hydroxybenzoic acid (both as the methyl ester of dicamba) in milk, muscle, liver, kidney and fat. The method has been successfully validated by the Agency using milk and ground beef samples (9/1/82, K. Zee, PP#1F2569).

OPPTS GLN 860.1360: Multiresidue Method

Although the petitioner requested a waiver for dicamba multiresidue method testing (S. Knizner, 11-JUN-1993, D189393 and D189595), documentation from the FDA PAM, Volume I, Appendix II and Table 201-D, shows that dicamba is partially recovered (71 - 76%) using Protocol B.

OPPTS GLN 860.1380: Storage Stability Data

BASF submitted the results of a frozen storage stability study for dicamba and its metabolite 5-OH dicamba in the following field corn RACs: forage, silage, grain, and fodder (S. Chun & W. Donovan, 16-JUL-1998, D228703). The results of this study show dicamba to be stable for up to 3 years in frozen storage, and 5-OH dicamba to

be stable for up to 2 years in frozen storage. As the sweet corn samples were stored for a maximum of 24 months, storage stability is not an issue for this petition.

OPPTS GLN 860.1500: Crop Field Trials

Submitted with this petition:

> Sweet Corn Residues of diflufenzopyr and Dicamba Resulting From Application of Distinct® (BAS 662 H) MRID# 451540-01.

A total of 9 field residue trials were conducted in 1996. These trials were located in Regions 1 (1 trial), 2 (1 trial), 3 (1 trial), 5 (3 trials), 6 (1 trial), 10 (1 trial) and 12 (1 trial). Four plots were established at each site. Treatment 1 was the untreated control. Treatment 2 consisted of 2 applications of diflufenzopyr at a rate of 0.05 lbs. ai/A for a total of 0.10 lbs. ai/A. Treatment 3 consisted of 2 applications of Distinct® at a rate of 0.125 lbs. dicamba/A for a total of 0.25 lbs. ai/A (1.2X). Treatment 4 consisted of 2 applications of dicamba at a rate of 0.25 lbs. ai/A for a total of 0.50 lbs. ai/A (2.4X). The first treatment was made when the corn was 12 inches tall; the second, when the corn was 24 inches tall. Two replicate samples were harvested from each treated plot 4-7 weeks (forage and ears) and 5-16 weeks (stover) after application. The samples were frozen and shipped to Sandoz. Sample analysis for and 5-OH dicamba was performed using method AM-0691B-0593-3. The method was validated over a range of 0.02-0.1 ppm. The average recovery was 84 ± 13% for dicamba and 88 ± 11% for 5-OH dicamba. Analyses of the treated samples (Tables 1 & 2) showed that the maximum total residues at 1.2X were 0.29 ppm in forage, 0.39 ppm in stover and <0.04 ppm in ears (kernel plus cob with husk removed).

Table 1. Residue levels of dicamba and 5-OH dicamba following Treatment 3 (0.25 a.i./A dicamba, 1.2X)

Trial Site	PHI (Weeks)	Dicamba (ppm)	5-OH Dicamba (ppm)	Total[b] (ppm)
Sweet Corn Forage				
WI	7	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
MN	6	<0.02	0.03	<0.05
		<0.02	0.05	<0.07
IN	7	<0.02	0.06	<0.08
		<0.02	0.06	<0.08
OR	8	<0.02	0.03	<0.05
		<0.02	0.04	<0.06
CA	6	0.10	0.11	0.21
		<0.02	0.08	<0.10
WA	4	0.05	0.31	0.26
		0.05	0.24	**0.29**
GA	6	<0.02	0.07	<0.09
		<0.02	0.07	<0.09
FL	4	0.03	0.22	0.25
		<0.02	0.13	<0.17
NY	4	0.03	0.13	0.16
		0.04	0.18	0.22
Sweet Corn Stover				
WI	10	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
MN	9	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
IN	11	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
OR	16	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
CA	13	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
WA	10	0.05	0.34	**0.39**
		0.04	0.24	0.28
GA	NC [a]	-	-	-
		-	-	--
FL	5	0.05	0.28	0.33

		0.03	0.21	0.24
NY	10	<0.02	0.03	<0.05
		<0.02	0.03	<0.05
Sweet Corn Ears				
WI	7	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
MN	6	NA	NA	NA
		NA	NA	NA
IN	7	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
OR	8	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
CA	6	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
WA	4	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
GA	6	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
FL	4	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
NY	4	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04

[a] NC = Not Collected
[b] NA = Not Analyzed

Table 2. Residue levels of dicamba and 5-OH dicamba following Treatment 4 (0.50 a.i./A dicamba, 2.4X)

Trial Site	PHI (Weeks)	Dicamba (ppm)	5-OH Dicamba (ppm)	Total[b] (ppm)
Sweet Corn Forage				
WI	7	0.054	0.15	0.20
		0.042	0.12	0.16
MN	6	<0.02	0.042	<0.06
		<0.02	0.058	<0.08
IN	7	<0.02	0.10	<0.12
		0.024	0.16	0.18
OR	8	0.096	0.30	0.40
		0.042	0.15	0.19
CA	6	0.087	0.17	0.26
		0.038	0.26	0.30
WA	4	0.14	0.92	1.1
		0.10	0.66	0.76
GA	6	0.043	0.14	0.18
		0.058	0.24	0.30
FL	4	0.22	1.5	1.7
		0.20	1.3	1.5
NY	4	0.099	0.82	0.92
		0.063	0.50	0.56
Sweet Corn Stover				
WI	10	0.047	0.13	0.18
		0.067	0.17	0.24
MN	9	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
IN	11	<0.02	<0.066	<0.09
		<0.02	<0.051	<0.07
OR	16	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
CA	13	0.026	0.093	0.12
		0.030	0.068	0.098
WA	10	0.072	0.57	0.64
		0.083	0.59	0.67
GA	NC[a]	-	-	-
		-	-	-
FL	5	0.27	1.5	1.8

		0.18	0.90	1.1
NY	10	0.028	0.076	0.10
		0.034	0.093	0.13
Sweet Corn Ears				
WI	7	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
MN	6	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
IN	7	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
OR	8	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
CA	6	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
WA	4	0.064	0.034	0.098
		0.081	0.043	0.12
GA	6	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
FL	4	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04
NY	4	<0.02	<0.02	<0.04
		<0.02	<0.02	<0.04

[a] NC = Not Collected
[b] NA = Not Analyzed

Conclusions: A total of 9 field residue trials were conducted in Regions 1 (1 trial), 2 (1 trial), 3 (1 trial), 5 (3 trials), 6 (1 trial), 10 (1 trial) and 12 (1 trial). The number and location does not match that required for sweet corn: 12 trials conducted in Regions 1 (2 trials), 2 (1 trial), 3 (1 trial), 5 (5 trials), 10 (1 trial), 11 (1 trial) and 12 (1 trial). The petitioner previously submitted the results of 20 field corn residue trials. HED can generally translate field corn forage and stover data to sweet corn. However, in this case, translation is not appropriate as the application rate in the field corn trials was >10X the maximum sweet corn application rate. HED thus requests that the petitioner submit an additional 3 sweet corn residue trials conducted in Regions 1 (1 trial), 5 (1 trial) and 11 (1 trial). Permanent tolerances and a conditional registration may be established while these trials are conducted. Based on the available data, the following tolerance for residues of the herbicide dicamba and its 5-OH metabolite are appropriate for this petition:

Corn, sweet, forage	0.50 ppm
Corn, sweet, kernel plus cob with husks removed	0.04 ppm
Corn, sweet, stover	0.50 ppm

A revised Section F is required.

OPPTS GLN 860.1520: Processed Food/Feed

As there are no processed commodities associated with sweet corn, processing studies not are required to support the subject petition.

OPPTS GLN 860.1480: Meat, Milk, Poultry, Eggs

Given that there are already dicamba tolerances established on major livestock feed items at high levels (i.e., aspirated grain fractions at 5100 ppm, grass forage at 125 ppm and wheat forage at 20 ppm), HED concludes that the dietary burden to livestock will not be affected by the use of dicamba on sweet corn.

OPPTS GLN 860.1850/1900: Confined/Field Accumulation in Rotational Crops

Based on the results of a confined rotational crop study, HED has concluded that the following plantback restrictions are appropriate (memo S. Chun & W. Donovan, 25-JUN-1998; D228694):

Application Rate	**Rotational Restrictions**
0.75 or less lb a.i./A	After 120 days from time of application: no rotational cropping restrictions apply. Planting within 120 days of application: only rotate to crops below.
0.75 to 2.0 lb a.i./A	Rotate to the following crops only: corn, soybeans, cotton, wheat, barley, oats, grass pasture and hay or rangeland, sorghum, asparagus, sugarcane.

As the application for sweet corn is <0.75 lb a.i./A, the plantback intervals specified on the Distinct® label (7 days for corn and 120 days for all other crops) are appropriate.

Other Considerations: There is neither a Codex proposal, nor Canadian or Mexican limits for residues of dicamba in/on sweet corn. Therefore, a compatibility issue is not relevant to the proposed tolerance. A copy of the IRLS sheet is attached to this memorandum.

Attachment 1- IRLS Sheet

cc: Kramer
RDI: G. Herndon(7/19/01), RAB1 Chemists (7/19/01)
G.F. Kramer:806T:CM#2:(703)305-5079:7509C:RAB1

INTERNATIONAL RESIDUE LIMIT STATUS

Chemical Name: 3,6-dichloro-o-anisic acid	Common Name: Dicamba	☒ Proposed tolerance ☐ Reevaluated tolerance ☐ Other	Date: 6/29/01

Codex Status (Maximum Residue Limits)	U. S. Tolerances
X No Codex proposal step 6 or above ☐ No Codex proposal step 6 or above for the crops requested	Petition Number: 6E06209 DP Barcode: D271606 Other Identifier:
Residue definition: N/A	Reviewer/Branch: G.F. Kramer
	Residue definition: parent + its 5-OH metabolite

Crop (s)	MRL (mg/kg)	Crop(s)	Tolerance (ppm)
		Corn, sweet, forage	1.0
		Corn, sweet, fresh	0.1
		Corn, sweet, stover	1.0

Limits for Canada	Limits for Mexico
☐ No Limits ☐ No Limits for the crops requested	☐ No Limits ☐ No Limits for the crops requested
Residue definition: dicamba	Residue definition: dicamba

Crop(s)	MRL (mg/kg)	Crop(s)	MRL (mg/kg)
corn (field and sweet)	none (default)	corn	0.5

Notes/Special Instructions:.
S. Funk, 07/03/01.

Rev. 1998